

### Remarks

Applicants are withdrawing at this time claim 11. Applicants agree with the Examiner that claim 11 should be included with the claims in Group II. It is noted that the Examiner understood that claim 11 is directed to a controller, rather than a method. The claims that are withdrawn in view of the restriction requirement in the Office Action dated July 18, 2005 are claims 8, 9, 11, 18 and 19.

Claims 2-6 and 10 are rejected under 35 U.S.C. § 112. Applicants are amending claim 10 at lines 7 and 8. The term "engine" at line 8 is changed to "power unit" since the term "power unit" is the antecedent in line 2 of the claim. This avoids the rejection of claim 10 based on 35 U.S.C. § 112.

Claim 14 now has been cancelled in favor of the claims presently submitted.

It is requested that the rejection of claims 2-6 under 35 U.S.C. § 112 be reconsidered. These claims do not recite additional method limitations or method steps not included in base claim 1. Rather, each of these claims 2-6 adds limitations or definitions for terms in the claims from which they depend respectively. For example, the storage device recited in claim 1 is identified in claim 2 as a battery. Likewise, the power unit recited in claim 1 is identified in claim 3 as an internal combustion engine. In claims 4 and 5, the parameters to which reference is made in their respective parent claims are identified specifically as the state of charge of the battery and the discharge power limit of the battery.

Claim 6 has been amended by changing the word "position" to "drive mode." This terminology is more appropriate. Corresponding changes have been made in the specification in paragraph 9. This terminology refers to the different threshold levels for reverse drive and forward drive indicated at Figure 3 of the drawings.

Applicants believe that the rejections of claims 2-6 and 10 under 35 U.S.C. § 112 now are overcome.

Claims 1-7, 10, 12, 13 and 15-17 now remain in the application. Claims 1-4, 7, 16 and 17 are rejected under 35 U.S.C. § 102(b) as being anticipated by reference patent 6,116,363. Claims 5, 10 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the '363 patent. Claims 6, 12 and 13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the '363 patent in view of reference patent 6,603,215. It is respectfully requested that the rejections based on 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) be reconsidered in view of the following remarks.

The method and apparatus of the '363 reference patent uses a control strategy or policy for operating an engine and a motor in a hybrid electric vehicle powertrain as a function of engine speed and battery SOC (or depth of discharge). In contrast, the method and controller of the present invention develops an engine on/off request based on battery SOC/DPL and current state of engine operation. This involves an arbitration of requests from an engine state machine that develops engine on and off requests using opportunistic mechanisms. Requests from the engine state machine, as well as other sources, are arbitrated using a priority scheme that evaluates the various requests.

The arbitration in Applicants' method and system takes into account, for example, a rate of change of a driver demand for power, battery temperature, whether the transmission is in forward gear or reverse gear, etc. before the engine is turned on or off.

It may be desirable, when the controller is in the opportunistic state, for example, to start the engine in order to charge the battery even if the battery SOC or DPL is low but not at a certain lower limit. Under other circumstances, the arbitration will not allow an engine start, even though an engine start request is made, until the engine should be started for other reasons.

The '363 reference patent discloses a controller for a hybrid electric vehicle in which the engine and the motor can be operated simultaneously or separately. They are operated simultaneously in a so-called HEV mode, but the motor alone provides power at the traction wheels if zero emission operation is desired. That is referred to as a ZEV mode. Typically, the control system described in the '363 patent provides for operation using the battery alone in city driving conditions. The HEV mode, in which the engine is on, is used under vehicle cruising conditions at a level above a predetermined speed limit. Because of the varying driving conditions inherent in a powertrain of this type, it is necessary to turn on the engine as a transition is made from a fully electric driving mode to the HEV mode. Further, frequent changes from the HEV mode to the fully electric mode are needed as the driving conditions change. In order to avoid unnecessary frequent stopping and starting of the engine as the driving conditions change, a control band between the "on" threshold plot 250, seen in Figure 4, and the "off" threshold plot 280, seen in Figure 4 is provided. This control band will avoid undesirable excessive cycling of the engine between an engine on state and an engine off state. This function of the controller of the '363 patent provides a typical hysteresis in the system.

The Examiner's attention is directed to column 8, lines 13-37, of the '363 patent. As the transition is made from the HEV mode to the fully electric drive mode in the case of the method of the '363 patent, a delay in turning off the engine occurs until the plot shown by the dotted line 280 in Figure 4 is reached. Conversely, when the vehicle is operating in a fully electric mode and it is necessary to transition to the HEV mode, there will be a delay in the transition until the transition plot shown at 250 in Figure 4 is reached. The control band, shown in Figure 4 of the '363 patent is not the equivalent of Applicants' opportunistic state, as suggested by the Examiner in paragraph 6 on page 3 of the Office Action. The region between plot lines 250 and 280 cannot be defined as an equivalent of Applicants' opportunistic state. That region merely provides a conventional hysteresis.

Applicants' controller and method makes use of an engine on/off arbitrator, as previously explained. The arbitrator receives requests to turn the engine off or an indication

that it is appropriate to turn the engine off. It also may receive a request from the battery controller that the engine be turned on or that the engine be kept on if the engine is already on. A request to turn the engine on or turn the engine off depends upon the state of charge or the discharge power limit that is monitored by the battery controller. The requests that are delivered to the arbitrator may come from various sources.

The arbitrator will evaluate the requests and will monitor a battery state of charge or the discharge power limit and will compare those parameters with the threshold levels indicated in Figure 3 of Applicants' drawings. It will issue a command to turn the engine on or off, depending upon the value of the discharge power limit or the state of charge of the battery and other variables. Applicants' control strategy is not merely a hysteresis feature, as indicated in Figure 4 of the '363 reference patent.

As indicated previously, the hysteresis feature in Figure 4 of the '363 patent merely is intended to avoid undesirable frequent starting and stopping of the engine each time the engine speed and battery depth of discharge values would reach the plot 250, shown in Figure 4 of the '363 patent. The hysteresis feature of the system of the '363 patent merely is intended to avoid turning the engine off if the point of operation only temporarily falls below a threshold while the engine is on. It also will avoid starting the engine when the motor is on and the operating point only temporarily rises above a threshold.

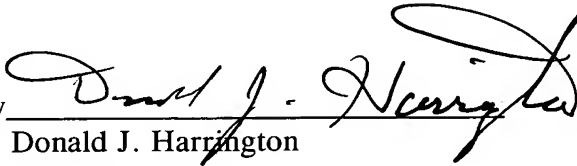
The rejection of claims 5, 10 and 15 under 35 U.S.C. § 103(a) as being unpatentable over the '363 patent, in Applicants' view, is overcome for the same reason, among others, that the rejection under 35 U.S.C. § 102(b) does not apply. The rejection of claims 6, 12 and 13 over 35 U.S.C. § 103(a) as being unpatentable over the '363 patent in view of the '215 patent, in Applicants' view, also is overcome for the same reasons discussed in the preceding paragraphs with respect to 35 U.S.C. § 102(b). The teachings of the '215 patent do not supply any of the deficiencies previously discussed with respect to the '363 patent. A person skilled in the art would not be motivated by the combined teachings of the references to practice Applicants' invention.

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A favorable consideration of the claims now appearing in the application is  
solicited respectfully.

Respectfully submitted,  
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